SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project and in our opinion, this project is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering (Hons.).

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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PERFORMANCE OF SOLID WASTE BY PRODUCT (PALM OIL CLINKER) AS PARTIAL COARSE AGGREGATE REPLACEMENT

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ABSTRAK

Kajian ini menerangkan eksperimen mengenai kesan penggantian klinker kelapa sawit (KKS) agregat terhadap sifat-sifat mekanikal konkrit yang terdiri daripada kebolehkerjaan, kekuatan mampatan dan kekuatan lenturan. Nisbah air simen yang paling sesuai bagi campuran untuk kajian ini diperoleh melalui campuran percubaan dan menghasilkan nisbah yang tetap iaitu 0.53. Peratusan KKS yang berbeza digunakan sebagai penggantian sebahagian agregat kasar yang terdiri daripada 0%, 5%, 10%, dan 15%. Setiap ujikaji adalah berdasarkan standard British. Kebolehkerjaan konkrit diuji dengan menggunakan ujian kemerosotan untuk menyemak ketekalan konkrit. Untuk kekuatan mampatan, sebanyak 36 kiub dengan saiz 150mm x 150mm x 150mm digunakan untuk menentukan kekuatan mampatan konkrit apabila menggantikan dengan 0%, 5%, 10% dan 15% KKS sebagai pengganti agregat kasar dalam konkrit. Kemudian, untuk jumlah kekuatan lenturan 36 prisma dengan saiz 150mm x 150mm x 750mm digunakan untuk menentukan kekuatan lenturan konkrit apabila menggantikan dengan 0%, 5%, 10% dan 15% KKS sebagai pengganti agregat kasar dalam konkrit . kekuatan mampatan dan lenturan telah dijalankan pada hari ke 7, 14 dan 28 untuk mendapatkan kekuatan konkrit. Semua ujian dibandingkan dengan konkrit normal. Kesimpulan yang dapat dibuat berdasarkan keputusan yang diperolihi ialah penggantian 10% dan 15% KKS mempunyai kebarangkalian untuk digunakan sebagai pengganti granit dalam industri pembinaan.

ABSTRACT

This research describes experimental studies on the effects of substitution of POC aggregates towards the mechanical properties of concrete which consist of workability, compressive strength and flexural strength. The most suitable water cement ratio for the mixture was obtained through trial mixtures and yielded a constant of 0.53. The different percentage of POC was use as partial coarse aggregate replacement which is consist of 0%, 5%, 10%, and 15% replacement by volume of granite. All of the testing were followed the British standard. The workability of concrete were tested by using slump test to check the consistency of freshly made concrete. For compressive strength, total of 36 cubes with size 150mm x 150mm x 150mm were used to determine the compressive strength of concrete when replace with 0%, 5%, 10% and 15% of POC as a replacement of coarse aggregates in concrete. Then, for flexural strength total of 36 prism with size of 150mm x 150mm x 750mm were used to determine the flexural strength of concrete when replace with 0%, 5%, 10% and 15% of POC as a replacement of coarse aggregates in concrete. Compressive and flexural strength were conducted at 7 days, 14 days, and 28 days to get the strength of concrete. All of the testing were compared with normal concrete. As the result were obtained, it can concluded that replacement of 10% and 15% POC had a probability to use as a granite replacement in construction industry.

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LIST OF ABBREVIATIONS

UMP	Universiti Malaysia Pahang
POC	Palm Oil Clinker
ASTM	American Society for Testing and Material
OPC	Ordinary Portland cement
ACI	American Concrete Institute
POCC	Palm Oil Clinker Concrete
NWC	Normal Weight Concrete
OHSA	Occupational Health and Safety Assessment
SSD	Saturated Surface Dry

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Concrete is a very strong and versatile mouldable construction material. It's well known as a composite static material that consist of aggregates, water and cement. Concrete is used in all types of construction, particularly commercial building, highway and residential building due to its great strength, affordability, durability, and versatility. Structures designed with concrete are more durable and can be engineered to withstand the natural disaster such as hurricanes, earthquakes, and also tornadoes. Due to fast growing construction industry, the demand for concrete has increased tremendously, causing deficiency of suitable raw material such as aggregate in concrete making process which lead to increases the construction cost. To alleviate this problem, engineers are not only challenged with the future homebuilding in terms of construction cost control but also the need to convert the industrial wastes to useful construction and building materials. One of such ways is to introduce industrial waste material into concrete. Such waste materials are wood chipping, silica fume, fly ash, crumb rubber, paper mill and palm oil clinker. The utilisation of these waste reduce the use of aggregate from natural sources and ensures sustainability.

Malaysia is one of the world largest producers of palm oil and generate significant amount of waste in the milling process. Palm oil mill in Malaysia incinerate palm oil waste to produce steam needed for the milling process. The waste product of incineration is palm oil clinker (POC). Instead of dumping the POC into environment, a better waste management option is to crush POC into desired sizes (coarse aggregate) and utilise it as aggregate to produce lightweight concrete. Currently, many research has been carried out in order to provide a strong and durable concrete with the utilising POC aggregate as full replacement to conventional fine and coarse aggregates. POC is a light solid fibrous

material which when crushed has the potential to be used as aggregate in lightweight concrete. The density and the strength of POC falls within the requirements of the structural lightweight concrete (*Neville AM, 1995*). The used of POC in construction industry will results in reducing the cost of raw materials which directly reduce the cost of construction.

1.2 Problem Statement

Concrete has been used globally in the construction sector. It disclosed that, natural raw materials such as aggregate have become more limited. The demand for natural aggregate is on the increase due to rapid infrastructure development. Thus, finding an alternative material that can serve as a replacement for natural aggregate is important to reduce the high demand. Since, palm oil industries is the most popular agro-industries in Malaysia, it is a chance to review the effectiveness of those waste industrial products as aggregate replacement.

In order to overcome this problem, the study carried out to determine the behaviour of waste industrial products which is POC as aggregate replacement within suitable percent. The vital constraints on the utilization of those waste materials, it should fulfil the engineering requirement in term of physical properties of concrete. Besides that, tests ought to be done on the concrete to make sure that the concrete beyond the prescribed specifications in terms of durability and strength.

1.3 Objectives of Study

The main objectives of this study are as follows:

i. To determine the workability of concrete when added with different percentage of palm oil clinker as a replacement of coarse aggregates.

ii. To determine the compressive strength of concrete when added with different percentage of palm oil clinker as a replacement of coarse aggregates.

iii. To determine the flexural strength of concrete when added with different percentage of palm oil clinker as a replacement of coarse aggregates.

1.4 Scope of Study

The scopes of study of this study are as follows:

i. The material use are POC, Portland cement, aggregate and water using ratio 1:3.

ii. POC was crushed and sieved to the desired particle sizes. Particles in the range of 5–14 mm are considered as coarse aggregate.

iii. The dimension of cube and prism chosen for compressive test and flexural test are 150 x 150 x 150 mm3 and 100 x 100 x 750 mm3 respectively.

iv. The approach used in the mix design involved POC replacement of 0%, 5%, 10%,15%, of the total volume of coarse aggregates.

v. Control mix was prepared using natural aggregates, such as river sand for fine aggregate and granite stone for coarse aggregate.

vi. The specimens are tested at the age of 7, 14 and 28 days of curing referencing British Standard (BS 1881), and American Society for Testing and Materials (ASTM C).

1.5 Significance Of Propose Study

This researched give further understanding on Palm Oil Clinker (POC) substitution toward concrete physical properties. Beside, determine how far the performance of POC in the making of concrete for construction industry and the effect of POC use on concrete prism strength properties based on the workability, flexural strength and compressive strength.

Furthermore, positive findings from this study can facilitate to promote the utilization of POC as construction materials and thus are going to be able to employ the agricultural waste within the country such palm oil clinker as a natural sources of construction materials. Therefore, it would help to minimize the adoption of aggregate, as well as reduce the construction cost. The success of this study will not only introduce the potential of POC in construction but also tends to minimize the construction failure.

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